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NATURAL HISTORY IN THE GRADES

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In a series of short articles it is my purpose to outline the natural-history materials that are suggested for each of the grades in the elementary school. This discussion presumes that work with nature may be so arranged as to have sequence in order of interest and difficulty of study. It presumes also that in each grade the training and information involved in the study of the materials of the preceding grade may be depended upon as the basis for succeeding work. It is recognized that in different localities there is greater variation in the materials for this work than in arithmetic or the languages, and that substitutions of other materials must often be made. In arranging these substitutions, however, selection should be so made that the new materials will serve similar interests, cultivate similar relative acquaintance on the part of the children, and have similar informational value. That any object in nature will suffice for the natural-history work of a given grade is no more and no less true than that any topic in arithmetic is quite as good as any other for use in this grade. A somewhat closely related body of knowledge organized upon a broad underlying educational purpose is essential to giving any subject a position of dignity in the school curriculum. Nature-study has by no means reached this dignified position of organization, but it is toward this end that its advocates are working.

In the grades three dominant attitudes of mind toward nature are noticeable. The younger children in grades one and two and sometimes in grade three appear to be interested primarily in finding out what and where things are and what is being done. This is chiefly an orientation attitude, one of development of speaking acquaintance with nature. Consequently during this period a relatively large number of things in the local environment may be studied, but not studied in detail.

In the intermediate grades the attitude of orientation and general acquaintance is not lost but added to it is a larger and more definite interest in knowing how and why things happen; this leads to a somewhat more intensive study of a smaller number of things, a study of causes, processes, and results, and of the relation of natural objects and processes to the needs of men. In the upper grades, seventh and eighth, and sometimes the sixth, the preceding interests are still present but there is an added interest in the use of nature and nature's forces in the industries and also in what may be called elementary science.

FIRST GRADE

In extending acquaintance with nature, obviously the work should begin with those things that are most closely related to the life and experiences of the home and school. These materials have been classified under the heads of (1) Animal Life, (2) Plant Life, (3) Garden Work, (4) Earth Materials, (5) Climatology.

1. *Animal life.*—Under animal life are included the horse, dog, cow, sheep, pigs, chickens, rabbits, squirrels, pigeons, doves, robin, English sparrow, crow, blue-jay, flicker, turtles, toads, fish, fly, mosquito, butterfly, and angle worm. Obviously acquaintance with several of these things will have been secured before the children come to the first grade, but they should be included in the outline lest some may not know them. Sometimes certain animals such as the cow and sheep, will not be observable, while at other times these will be so well known that others may more profitably be substituted for them. Out of the entire list will be found those that will make up an adequate amount of animal work for the first grade regardless of the differing degrees of acquaintanceship that pupils already have. The point to be made perfectly clear is that at the end of this grade the children should know the things included in the outline and have considerable general knowledge of their habits. Many of them in connection with casual observations will know something of animals such as the polar and black bear, deer, and buffalo; and descriptions, pictures, and true stories concerning

these animals will prove valuable. Local animals, however, are the ones upon which the regular work should be based.

In the schoolroom aquaria some of the smaller water animals may be grown and used for daily observation. In a box covered by wire or mosquito netting toads may be kept. During all favorable weather the box should be kept out of doors in a cool shady place. Hodge's *Nature-Study and Life* contains an excellent discussion of work with the toad. If suitable places for such work may be had some of the larger animals should be kept by the children, as a pair of rabbits, and hen and chickens. A well-trained dog may be made extremely valuable for a few days in the schoolroom, and horses are so abundant that more or less intermittent observations upon them are possible. Animals that the children have as pets in their homes may often be secured for school use.

2. *Plant life.*—Materials suggested for study are such vegetables as beets, potatoes, radish, lettuce, asparagus, cabbage, rhubarb, parsley, cauliflower; such fruits as apples, oranges, lemons, bananas, melons, pumpkins, pineapples, berries; such house plants as geranium, nasturtium, ferns, mosses, palms; such trees, shrubs, and herbs as the oak, elm, maple, lilac, dandelion, plantain; and finally a few bulbous plants such as tulip and narcissus.

3. *Garden work.*—Window boxes in which are grown several of the plants mentioned above are valuable. By constructing the window boxes in such a way that they may stand within a galvanized iron pan proper watering and drainage may be had; plants may be germinated and grown, and seed matured inside the room. Decorative plants should be used almost exclusively in these boxes, and their habits and the care requisite to proper growth should be made points of special study.

Outdoor gardens should consist of one vegetable and one flower garden for the grade. In the window boxes decorative plants, as geranium and nasturtium, may be prepared for later planting out of doors; also many vegetables may be started in small boxes or pots for transplanting thus giving profitable indoor work and an earlier result in the outdoor garden. One-inch pots in which each child plants a few radish or lettuce seeds give plants which may readily be transplanted as suggested below. In the outdoor gardens children of this grade can do little cultivation except such as is done by weeding and by use of small single-hand tools.

Names and characteristics of the common garden plants should be learned and some knowledge should be secured of proper ways of planting and caring for each. Beets, radish, and lettuce suggested for the grade's group garden furnish types of plants that the children must grow from seed which they should plant at the time when outdoor garden work may be begun. If planted too deep the young plants will not live to reach the surface, and if too shallow excessive dryness, heat or cold may injure them. Radish and lettuce seed should be planted at a depth of one-half inch from the surface and beet seed at a depth of one inch. The rows of radish and lettuce should be six inches apart with fifteen to twenty seeds to the foot, while beet rows should be one foot apart and the number of seed per foot should be ten or twelve. It will be well to plant in a box or pot in the schoolroom a week or two before beginning the outdoor garden work a few of each kind of seeds to be used in order that the pupils may learn the characteristic appearance of the different kinds of seedlings before they appear in the gardens. This helps to distinguish the desired plants from the weed seedlings that are certain to develop.

Cabbage, cauliflower, and tomato furnish types of vegetables that need to be started in the schoolroom early enough so that plants three or four inches in height above the ground may be had for transplanting, when the weather is suitable for outdoor planting. In transplanting care must be taken first to remove the plants without injuring the roots, which can be done by moistening the soil, then carefully lifting the plants by use of a dull knife or the fingers. Secondly, in resetting each plant there should be made an opening in the soil amply large enough to allow the roots to be spread out in their normal position. Upon the well-spread roots, sprinkle a half-inch of fine soil and then water carefully so that the soil is well settled about the roots, thus in a measure reproducing the relations that previously existed between the soil and the roots. After watering fill in soil about the plant until the opening is filled. The plant is then ready to begin work in its new location. It should be remembered, however, that these plants are not yet able by means of their recently disturbed roots to secure a large supply of water, and should excessive drying of the leaves occur the demand upon the roots for water would be greater than could be met, hence the necessity, in case of hot, dry weather, of covering the plants for a day or two by use of old newspapers or of inverted earthen pots.

The potato offers still another method of starting plants, and at least one or two hills should be planted so that the pupils may observe the cutting out, planting, and development of the "eye" or bud from which the new plants are propogated. Direction for the growth and care of nearly all the garden vegetables may be found in French's *A Book of Vegetables,* published by the Macmillan Company at a cost of $1.75. Suggestions concerning work with bulbous plants may be found in the October *Elementary School Teacher,* pp. 86–88.

4. *Earth materials.*—The names, and general characteristics of rock, clay, sand, and loam may properly constitute earth work in this grade. If the garden work precedes this study much general data will have been secured, and that may now be used as the basis for the beginning discussion. Rocks of all available kinds should be collected. At the outset simply ask that different kinds of rocks be brought to the schoolroom, after which there will doubtless develop many lines of difference, as those of color, form, size, hardness, and composition. If the stones are not fairly clean they should be washed so that their true appearance may be had. Have the pupils classify the stones according to color, then examine to see if they can determine different structures between stones of different colors, and between stones of the same colors. To enable pupils to observe composition, freshly broken faces of stones are best. Compare the hardness of the different stones and arrange them in a series of decreasing hardness. Compare the hardness and the weight. Measure the larger

pieces of stone that are fairly regular in form and weigh carefully. Determine whether hardest stones are heaviest. By the above and other similar methods of study there should be developed clear general ideas about at least several kinds of rocks such as quartz, limestone, sandstone, and shale. Various kinds of crystal stones are likely to be found; also some stones containing fossil remains will prove of great interest and will demand simple explanations.

After having studied stones, work may be done with gravel, sand, clay, and loam, first by noting general appearances, then by studying the texture of each and making comparisons. Gravel soils when sifted first with a coarse sieve then with a fine one prove instructive by demonstrating the gradations in breaking of the rock particles. From such gravel soils composed of different sized stones, sand and sometimes loam may be secured. If some disintegrating sandstone can be secured, it will, when studied together with coarse and fine sand, make the connection between stones and sand. Clay is but very finely divided particles of sand together with relatively small quantities of material resulting from the decay of animal and plant bodies. Pupils may determine its texture and rigidity as compared with other soils. Sandy loam should be sifted to discover the sand and remains of plant and animal decay that compose it. In this grade little or no attempt should be made to study the water-holding, ore-carrying power of soils, but in connection with window boxes and garden work the kinds of soils in which plants thrive best should be noted. Valuable suggestions for this study may be had in a pamphlet entitled *How to Read a Pebble,* by F. L. Charles, University of Illinois, Urbana, Ill. This pamphlet may be secured from the author, postpaid, for twenty-five cents.

5. *Climatology.*—The length of day and night; the position of sun, moon, and stars; clouds, dew, rain, snow, frost, ice, steam; air currents, wind, carrying power of wind, storms. A simple weather record kept upon the board or upon a chart for a few weeks will serve as the basis for the study of the weather, and will stimulate observation while the pupils are on their way to and from school. A chart blank with spaces for a month's

record may be made to include the days of the week, the number of days in the month and the weather record for an entire month. To furnish the data for making this record, the children must observe accurately, read the thermometer carefully, and report in terms that are definite. Determination of quantity of precipitation should not be expected in this grade.

		Monday	Tuesday	Wednesday	Thursday	Friday
Date						
Length of day	Sunrise Sunset					
Temperature	At opening of school At noon At close of school					
Character of the day. Include the time of each observation, cover points as cloudy, clear, rainy, variable, frost, dew, snow						
Wind. Its direction, constancy, strength, stormy						
Moon. Time of rising, its size, and changes						

The accompanying plan for keeping records, while extremely simple, provides for things that first-grade pupils may determine. In doing the work involved in keeping this record, training will be given in accurate observation as in reading the thermometer, in noting the kind of day, in securing from the daily paper the time of sunrise and sunset. In deciding just how to express observations of phenomena training will be given in choice of accurate and adequately descriptive words.

If a month's records are kept in this way interesting comparisons are then possible. Some of the questions suggesting these comparisons are: How many partially or wholly rainy days were there in the month? How many cloudy days? How many entirely clear days? What variations in temperature have there been in any single day? Is there a regularity in daily temperature variations? Is the whole day warmer or colder at the close of the month than at the beginning? Are cloudy days the coldest days?

Although the materials suggested herein are arranged under five headings, it does not follow that one group is to be finished before another is begun, nor that groups should be studied in the order given. In actual practice it has not been found possible nor desirable to study materials as classified into separate groups. Availability of materials, seasonal changes, previous experiences of the pupils, and individual preferences of the teacher help to determine the order of consideration of topics. It is hoped that at a later date there may be published a more detailed suggestion of the order of topics in making up the year's course. In all the work of this grade as well as in the immediately succeeding grades the natural history and different forms of work in expression run closely together. Well-made sentences and sketches in description of the things observed are invaluable to proper observation and interpretation, and the pupils should understand that they must see and know things well enough to enable them to express to others what they see and know.